

REDUCING PEDESTRIAN CRASHES AMONG CHILDREN*

DAVID F. PREUSSER, PH.D.

Principal and Associate
Dunlap and Associates, Inc.
Norwalk, Connecticut

APPROXIMATELY seven to eight thousand pedestrians are struck by motor vehicles and die each year in the United States.¹ Estimates on the number of injured range from 100,000 to 200,000 annually. While individuals of any age may be struck by a vehicle and injured, the problem is particularly severe for young children and senior citizens. Children are greatly overrepresented in the numbers of people struck.² Seniors are greatly overrepresented among deaths presumably because of their inability to withstand crash forces and to recuperate from crash injuries.³

The present paper will examine the pedestrian crash problem as it relates to children. It will discuss the nature of the problem and some of the already developed behaviorally oriented safety education programs.

Much of the work covered in this paper was funded by the National Highway Traffic Safety Administration and is the result of a long-term program to reduce pedestrian injuries. This program began in the early 1970s with an epidemiological study of the characteristics and causes of pedestrian crashes in urban areas.⁴ A similar effort covering suburban and rural crashes was conducted during the mid-1970s.⁵ Both of these studies relied on police accident reports, on-site investigations, and follow-up interviews to determine: behavioral errors, incorrect or unsafe behaviors which tend to precipitate accidents because of their relatively high risk; environmental factors, elements in the environment which predispose an accident to occur, i.e., increase the probability that a behavioral error will result in an accident; and situational factors, the demographics and socioeconomics of the accident victims as well as any temporal characteristics which distinguish the accidents.

Prior to these studies, much pedestrian safety training in the United States was relegated to telling children to "cross at the green," "watch for cars," and "be safe." After these studies, pedestrian safety education could con-

*Presented in a panel, Behavioral Interventions, as part of a *Symposium on Motor Vehicle Injuries* held by the Committee on Public Health of the New York Academy of Medicine on December 7, 1987.

centrate on teaching far more specific safe behaviors. These and other studies^{6,7} also demonstrate that pedestrian crashes were not merely random events but could be characterized by recurring patterns and behavioral errors found year after year in city after city.

PROBLEM OVERVIEW

The table shows the distribution of all pedestrian crash involvements by pedestrian age in Wisconsin for the years 1980–84. The data are shown separately for the City of Milwaukee, the state's largest city, and for the rest of the state, which includes suburbs, smaller cities, towns, and rural areas. Wisconsin data are used here only as an illustration, and similar distributions of crashes by age could be found in many other states.

In Wisconsin, as in other states, pedestrian injuries tend to be an urban problem. Milwaukee, which accounts for only 14% of the state's population (1980 census), had 35% of the state's reported pedestrian crash involvements during the 1980–84 time period. In Milwaukee, as in other American cities, the urban pedestrian injury problem tends to be particularly severe for children. Milwaukee children ages 0–14 account for only 22% of the city's population (1980 census), yet they had 41% of the city's reported pedestrian crash involvements.

Particularly for urban children, the most vulnerable ages are from about three or four (when children start to move beyond the boundaries of their own homes) to about the age of seven or eight (when children start to understand the meaning of roads, cars, accidents, and danger). The remainder of this paper will discuss the characteristics of child crashes and what can be done to prevent them. Safety education is discussed in terms of preschool children, basic safe street crossing education for young school aged children, and more advanced education for older children.

PRESCHOOL

The most common child pedestrian crash for both preschool and older children is the "midblock dart and dash" in which the child simply runs into the street, comes out from between parked cars, or otherwise gives the driver no warning.^{4,6} Drivers are usually helpless to avoid hitting such a small, fast moving target. These crashes usually occur on quiet residential streets during the afternoon and early evening.

The recommended approach to dealing with the preschool pedestrian crash problem is to keep these children away from traffic as opposed to trying to

WISCONSIN PEDESTRIAN CRASH INVOLVEMENTS BY AGE 1980-1984

<i>Pedestrian age</i>	<i>City of Milwaukee</i>		<i>Wisconsin (excluding Milwaukee)</i>	
	<i>Number</i>	<i>Percent</i>	<i>Number</i>	<i>Percent</i>
0-2	83	2.2%	119	1.6%
3	93	2.4	133	1.8
4	115	3.0	175	2.4
5	165	4.3	242	3.3
6	192	5.0	247	3.4
7	177	4.6	248	3.4
8	138	3.6	196	2.7
9	118	3.1	170	2.3
10	95	2.5	134	1.8
11	101	2.6	165	2.3
12	97	2.5	138	1.9
13	95	2.5	173	2.4
14	93	2.4	168	2.3
0-14	1,562	41%	2,308	32%
15 and older	2,274	59%	4,943	68%
Total	3,836	100%	7,251	100%

teach them how to cross the street safely.⁸ Children of these ages do not yet have the capacity to deal with roads and vehicles and reliably to make the time, speed, and distance judgments needed to cross safely. Also, these very young children can become absorbed in play and run into the street without ever realizing that they could be entering the path of a vehicle.

England, Norway, Sweden, West Germany, and Japan have formed child traffic safety clubs to help parents teach road safety to their preschool children. Three and four year olds are taught to recognize cars, curbs, sidewalks, and streets. This forms a learning base so that as they grow older they will be ready to learn about safe street crossing. In the United States the American Automobile Association has produced a series of pamphlets designed to help parents work with their preschool children and "learn by doing." The National Safety Council distributes the "Watchful Willie" program designed primarily for use by preschool teachers, and the National Highway Traffic Safety Administration has developed materials for an American child traffic club. The objective of these materials is to teach preschool children to recognize the street and not to go into the street without the help of an adult.

Three special hazards are also a problem for young children. One of these is the "backing" accident. One potential countermeasure for these crashes is to ask drivers to walk behind their vehicles before getting in and backing out of a residential driveway or parking area.³ Another special hazard is the ice

cream truck or “vendor” accident since children are likely to dart into the street from any direction near the truck. A successfully evaluated countermeasure for vendor crashes is to require all motorists approaching the truck to come to a full stop before passing the truck.⁹ The third special hazard concerns small riding toys. These typically have three wheels, are made of plastic, allow a child to pedal very quickly, and do not belong in the street under any circumstances. The National Highway Traffic Safety Administration has produced a television spot advertisement which advises parents never to let their children take these toys into the street.³

SCHOOL CHILDREN

Five- and six-year-old children will walk to a school bus stop, or be given the freedom to walk beyond their own home. These children cannot be under adult supervision all of the time that they are on or near a roadway. Therefore, they must be provided with basic safe street crossing information. This is accomplished through the “Willy Whistle” program^{6,10} and through “Anti-Dart-Out Training,”¹¹ both of which were developed by the National Highway Traffic Safety Administration.

The specific advice taught to children in these programs is designed to reduce the incidence of child midblock dart and dash crashes. It covers the following three behaviors to be used wherever and whenever they are about to enter a street: always *stop* at the curb or at the outside edge of a parked car; always *look* left-right-left before entering the roadway; and if you see a car coming, wait until it passes and look left-right-left all over again until you don’t see any cars coming. The stopping behavior gives the child a chance to see oncoming vehicles and gives drivers a chance to see that a child is about to cross the street. The left-right-left looking behavior begins on the left since that is the direction of the most likely immediate threat.⁴ Then the child is told to look to the right to see if any cars are coming from that direction and then back to the left just before leaving the curb. (In England, where vehicles drive on the left side of the road, the recommended pattern is right-left-right.) Finally, the child is told not to cross the street if there is a car coming from any direction since children of this age cannot reliably make the time, speed, and distance judgments safely to cross in front of an oncoming vehicle.¹²

The “Willy Whistle” program consisting of an in-class film, six television spots, and a poster was evaluated in three field tests.^{6,10} This evaluation was structured around a “model” of the process by which public education can be used to produce crash reduction.¹³ This model stipulates that, to be effective,

public education materials (e.g., film, television spots, and poster) must be seen by the target audience (message transmission), the target audience must learn the recommended safe behaviors (knowledge gain), and the target audience must utilize these behaviors in on-street situations (behavioral change).

The field tests were conducted citywide in Los Angeles, Columbus, Ohio, and Milwaukee during the 1970s. The first step in these tests was to distribute the materials to schools and television stations. The schools showed the film to the target audience and utilized the posters. Television stations utilized the spots extensively since, unlike adult-oriented public service messages, there was little competition for child-oriented public service air-time. By May of 1978, 71% to 85% of a sample of the target age children in each of the three cities responded "yes" to the question "Do you know who Willy Whistle is?"

The next step was to determine whether the children learned about safe street crossing. The results, based on a sample of target age children in each of the three cities, showed substantial and statistically significant knowledge gains with respect to stopping at the edge of a parked car, looking left-right-left and waiting and looking again if a car is coming.

The next step was to determine if these knowledge gains were translated into safer on-street crossing behaviors. Observers, stationed near elementary schools and in residential neighborhoods in each of the three cities, observed naturally occurring child street crossing behavior before the "Willy Whistle" program was introduced, during the program period, and at the end of the program. The results showed statistically significant improvements in each of the three cities with respect to looking behavior and some improvement with respect to stopping at the curb or at the edge of a parked car.

Clearly, children had been exposed to the materials (message transmission), they had learned safer street crossing behaviors (knowledge gain), and they had adopted safer on-street crossing behaviors (behavioral change). Thus, it was reasonable to expect a reduction in child pedestrian crash involvements of the type addressed by the "Willy Whistle" program. Namely, it was reasonable to expect a reduction in child midblock darts and dashes.

Crash reduction was assessed by reading and coding all child pedestrian accident reports in each of the three test cities for a period of three years prior to the start of the program and two years after the program was implemented. The results showed that each city experienced a statistically significant reduction in child midblock dart and dash crash involvements. Summed across the

three cities, there was an average of 930.0 child (ages 0–14) midblock dart and dash crash involvements per year before the program was implemented. This figure dropped to an average of 734.0 involvements during the program period for a reduction of 21%. For comparison purposes, all other child pedestrian crash involvements (i.e., not midblock dart and dash crashes) averaged 943.0 per year prior to the program and 916.5 during the program for a reduction of 3%.

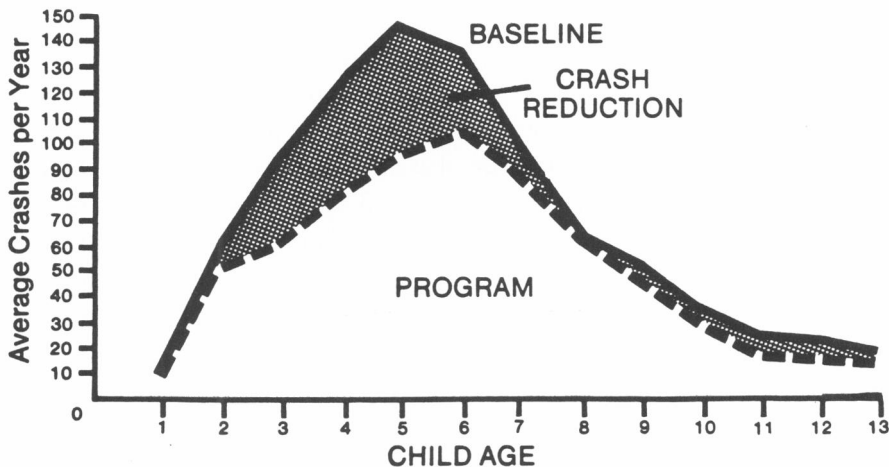
Separate analyses were conducted examining the crash reduction as a function of child age. Midblock darts and dashes are a particular problem for younger children and the program was primarily designed for grades K–3. The results, shown in the figure, indicated that “Willy Whistle”’s effect was greater for children between the ages of about three and seven with a 31% reduction for midblock dart and dash crash involvements for four, five, and six year olds.

It was concluded that the program was effective in reducing midblock dart and dash crash involvements for young children. These results were comparable to those experienced in England with the “Green Cross Code” (a similar child pedestrian safety campaign) which showed an 11% overall reduction and greater reductions for 5–9 year olds.¹⁴ However, the “Willy Whistle” program had little or no effect on older children and the more complex types of pedestrian crashes commonly experienced by older children as they venture further from their own residential neighborhoods.

OLDER CHILDREN

By the ages of eight, nine, and ten, children have more freedom and are allowed to walk to places well beyond their immediate neighborhood. They cross the street at signalized intersections and encounter other complicated parts of the road network. The basic stop and look left-right-left advice is still appropriate, but must be applied in a variety of complex situations. In fact, older children are involved in many of the same types of pedestrian crashes that are common for adults.

The National Highway Traffic Safety Administration has produced a new film entitled “And Keep on Looking” to deal with the problems encountered by older children.³ The objective of this film is to teach older children how to apply the basic stop and look left-right-left advice at intersections and on busy streets. The film covers the special hazard of vehicles making a right turn on red¹⁵ as well as other turning vehicle situations. It also covers the meaning of lights and signals, crossing multilane roadways, and walking in



Child midblock dart and dash accidents by age—Los Angeles, Columbus, and Milwaukee. From Blomberg, R.D., Preusser, D.F., Hale, A., and Leaf, W.A.: Experimental Field Test of Proposed Pedestrian Safety Messages. Final report to U.S. Dept. of Transportation, Contract DOT-HS-4-00952. Norwalk, CT, Dunlap, 1983.

parking lots. The behaviors shown in the film deal with where to stop, how to look, and what to look for in complex situations.

“And Keep on Looking” is currently being evaluated by the Insurance Institute for Highway Safety. This evaluation is proceeding in much the same way as the earlier evaluation of “Willy Whistle” in that knowledge gain and behavioral change are being measured. Preliminary analyses of crash data suggest that the film can reduce crashes among the target group of nine- to twelve-year-old children.

In conclusion, research has shown that child pedestrian crashes are not merely random events. Common causes and characteristics for these crashes occur year after year in city after city. One approach for dealing with these problems has been pedestrian safety education delivered by parents and teachers. Behaviorally oriented education tailored to the age level of the child and directed at the known highway hazards that the child is likely to encounter has been shown to reduce crash involvements.

SUMMARY

Crashes involving pedestrians and motor vehicles are more common in urban as opposed to nonurban areas. Within urban areas, children are particularly vulnerable. The most common child pedestrian crash is the midblock dart and dash in which the child appears suddenly in the roadway and the

driver has little chance to avoid an accident. Educational safety countermeasures for preschool children have concentrated on teaching the child to learn to recognize curbs, streets, and roads and not to go into the street without the aid of an adult. Young school age children should learn always to stop and look left-right-left to be sure that no cars are coming before entering the street. Programs teaching these stop and look behaviors demonstrably reduce crashes. Older children encounter the full complexity of the road network and should learn how to apply the basic stop and look left-right-left advice at intersections, on multilane highways, and in other complicated roadway situations.

REFERENCES

1. U.S. Department of Transportation: *Fatal Accident Reporting System 1984*. Washington, D.C., 1985.
2. Tobey, H.N., Shunamen, E.M., and Knoblauch, R.L.: *Pedestrian Trip Making Characteristics and Exposure Measures*. Final Report to U.S. Department of Transportation, Contract DTFH61-81-C-00020. Great Falls, VA, Center for Applied Research, 1983.
3. Preusser, D.F., Blomberg, R.D., Edwards, J.M., et al.: *The Development and Test of Urban and Rural Pedestrian Safety Messages*. Final Report to U.S. Department of Transportation, Contract DTNH22-80-R-07475. Norwalk, CT, Dunlap, 1983.
4. Snyder, M.B. and Knoblauch, R.: *Pedestrian Safety: The Identification of Precipitating Factors and Possible Countermeasures*. Final Report to U.S. Department of Transportation, Contract DOT-FH-11-7312. Silver Spring, MD, Operations Research, 1971.
5. Knoblauch, R.L.: *Causative Factors and Countermeasures for Rural and Suburban Pedestrian Accidents: Accident Data Collection and Analysis*. Final Report to U.S. Department of Transportation, Contract DOT-HS-802-266. Falls Church, VA, BioTechnology, 1977.
6. Blomberg, R.D., Preusser, D.F., Hale, A., and Leaf, W.A.: *Experimental Field Test of Proposed Pedestrian Safety Messages*. Final Report to U.S. Department of Transportation, Contract DOT-HS-4-00952. Norwalk, CT, Dunlap, 1983.
7. Blomberg, R.D., Preusser, D.F., Hale, A., and Ulmer, R.G.: *A Comparison of Alcohol Involvement in Pedestrians and Pedestrian Casualties*. Final Report to U.S. Department of Transportation, Contract DOT-HS-4-00946. Darien, CT, Dunlap, 1979.
8. Blomberg, R.D. and Preusser, D.F.: *Identification and Test of Pedestrian Safety Messages for Public Education Programs*. Final Report to U.S. Department of Transportation, Contract DOT-HS-099-3-705. Darien, CT, Dunlap, 1975.
9. Hale, A., Blomberg, R.D., and Preusser, D.F.: *Experimental Field Test of the Model Ice Cream Truck Ordinance in Detroit*. Final Report to U.S. Department of Transportation, Contract DOT-HS-5-01144. Darien, CT, Dunlap, 1978.
10. Preusser, D.F. and Blomberg, R.D.: Reducing child pedestrian accidents through public education. *J. Safety Res.* 15(2):47-56, 1984.
11. Dueker, R.L. and Berger, S.S.: *Experimental Field Test of Proposed Anti-Dart-Out Training Programs*, volume 2: *Implementation Guidelines and Program Materials*. Final Report to U.S. Department of Transportation, Contract DOT-HS-806-196. Valencia, PA, Applied Science Associates, 1981.
12. Salvatore, S.: *The Ability of Elementary and Secondary School Children to Sense Oncoming Car Velocity*. Washington,

- D.C., Govt. Print. Off., 1972.
13. Preusser, D.F. and Blomberg, R.D.: Development and Validation of a Road Safety Public Education Process. In: *Road Users & Traffic Safety*, Rothengatter J.A. and DeBruin, R.A., editors. Assen/Maastricht, the Netherlands, Van Gorcum, 1987.
 14. Morris, J.P.: *Road Safety Publicity—Quantifying the Effectiveness of Public Service Advertising*. London, Advertising Association, 1972.
 15. Preusser, D.F., Leaf, W.A., DeBartolo, K.B., et al.: The effect of right-turn-on-red on pedestrian and bicyclist accidents. *J. Safety Res.* 13(2):45–55, 1982.